Site Need Statement

General Reference Information	
1 *	***Need Title*:** Rapid Polychlorinated Biphenyl (PCB) Measurement System
2 *	***Need Code:*** RL-WT117
3 *	***Need Summary*:** Availability of a commercially available measurement system for congener specific PCB analyses.
4 *	***Origination Date*:** November 2001
5 *	***Need Type*:** Technology Need
6	***Operation Office*:** Office of River Protection (ORP)
7	***Geographic Site Name*:** Hanford Site
8 *	***Project*:** Safe Storage PBS No: RL-TW03
9 *	***National Priority:*** _X_ 1. High - Critical to the success of the EM program, and a solution is required to achieve the current planned cost and schedule. ____ 2. Medium - Provides substantial benefit to EM program projects (e.g., moderate to high life-cycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays). ____ 3. Low - Provides opportunities for significant, but lower cost savings or risk reduction, may reduce the uncertainty in EM program project success.
10	***Operations Office Priority*:**
Problem Description Information	
11	***Operations Office Program Description*:** The overall purpose of the safe-storage function is to operate and maintain the double shell tank (DST) and single shell tank (SST) farms in a safe and compliant manner until the contained wastes are retrieved and the tank farms are ready for closure. This includes performing day-to-day operations, maintaining and upgrading infrastructure, resolving safety issues, assessing tank integrity, characterizing the waste, and managing the DST waste inventory. This function also includes interim stabilization of selected SSTs. The end state of safe storage is containment of DST and SST tank wastes in a manner that supports safe waste retrieval for final waste disposal; tank-farm structures, including DSTs and SSTs, ready for final disposal and closure; and tank farms amenable and ready for the mitigation of any environmental releases that occurred during storage and retrieval of tank waste.
12	***Need/Problem Description*:** An EPA accredited technology is needed to measure the concentration of congeners of PCB compounds in highly radioactive waste samples. This technology is to be suitable for application inside hotcells, operated remotely, and insensitive to radiation levels commonly encountered in this environment. The existing laboratory methodology is very labor intensive, exposes personnel to ionizing radiation which is not ALARA compliant, and turnaround time of analytical results is poor. The result of these factors include the cost, about $5000 per analysis, the number of samples a technician can prepare is limited by the radiation dose accumulated. Analytical data is not always available when needed by the user. ** **Program Baseline Summary (PBS) No.:** RL-TW03 ** **Work Breakdown Structure (WBS) No.:** 5.01.01.02, 5.01.03.06.01.04 ** **TIP No.:** The requested technology would supplement or replace the baseline methodology in the Hanford Site laboratory(s) performing PCB analyses.
13	***Functional Performance Requirements*:** The system must be capable of performing the measurement on samples of solids, aqueous liquids, and liquids containing organic compounds. The system must quantitate the concentration of the congeners identified in method 8082 of the EPA compendium of procedures "Test Methods for Evaluating Solid Waste; SW-846". Detection limits must sufficient to assure the sample matrix is not regulated as a TSCA

	waste. The measurement must be capable of remote operation and provide an electronic output compatible with a common personal computer operating system.
**	***Schedule Requirements:*** Earliest Date Required: FY 2002; (Product would be used today, if available). Staging and transferring feed for the vitrification process will require rapid turnaround time on the most radioactive wastes in the FY 2007 time period. Design of the plant feed treatment process is in progress and the concentrations of PCB contained in wastes are important to the successful pretreatment module process design. **Latest Date Required:** Product would be used throughout retrieval and processing of tank waste.
14	***Definition of Solution*****:** Availability of a low cost, commercially available PCB Measurement System
15 *	***Targeted Focus Area*****:** Tanks Focus Area
16	***Potential Benefits*****:** The analyses identified in ORP-RPP interface control documents that must be performed prior to transfer of feed to the vitrification plant are extensive. Laboratory analyses are always expensive and time consuming, especially when the samples are highly radioactive and much of the sample preparation and analyses must be performed in a hotcell. PCB analyses are exacerbated by the long time the extraction and quantitation requires when the performed according to the standard EPA accepted procedure; therefore the cost is about $5000 for each sample. The proposed rapid screening system is anticipated to reduce the cost of each analysis to about $100 including the quality assurance that is required to assure the quality of the analysis. This system is also expected to reduce the number of reruns due to anomalous occurrences during the extraction and quantitation process since the procedure used will be greatly simplified. The time required to perform the analysis using this proposed technology is expected to be no more than 3 hours rather than the week or more with the standard method.
17 *	***Potential Cost Savings*****:** $100,000/tank of Waste Treatment Plant feed
18 *	***Potential Cost Savings Narrative*****:** The cost of an analysis by the requested technology is expected to be about $100, a saving of $4900 for each sample. The same quality assurance and detection levels will be performed using this unit. Assuming ten samples make up each of two full depth samplings (20 samples) are required to characterize each shipment of feed to the vitrification plant. Almost $100,000 could be realized in savings on each tank of waste prepared for transfer to the Waste Treatment Plant. In preparation for retrieval of wastes from single shell and double shell tanks, PCB analyses will be required in order to stage the waste feed such that it is acceptable to the Waste Treatment Plant. Delays in data availability are expected with the current technology because of the long time period required to perform the laboratory analysis. The technology is expected to be simple to operate; therefore, the analysis may be performed inside a hotcell by trained persons. This will significantly reduce the personnel radiological exposure and accelerate the availability of data by eliminating the steps necessary to load out aliquots from the hotcell and get them into the laboratory analyses schedule. No credit is calculated for radiation dose reduction.
19	***Cultural/Stakeholder Basis*****:** The Washington State Department of Ecology issues and monitors the operating permits of processes. They normally accept EPA accept measurement systems for the measurement of hazardous emissions and the proposed technology will have secured that acceptance.
**	***Technical Basis:*** ICD 19 and ICD 20 No measurement system currently exists that can provide reliable, rapid PCB concentrations in waste tank samples. The only recourse is to perform a laboratory measurement that requires approximately one week to complete, exposes personnel to high levels of ionizing radiation, and costs approximately $5000 for each sample. Acceptance criteria of waste volumes required by the ICDs includes PCB concentration data.

	The requested measurement system is expected to provide a means of reliably determining the concentration of all congeners of PCB compounds at the regulated concentration limit. Separation from the sample matrix produces no secondary or hazardous waste, and costs less than $100 to produce results on each sample.
20	***Environment, Safety, and Health Basis:*** The EPA methods are designed for analysis of soils and waters that do not contain radionuclides and therefore specify use of very large sample sizes. These methods have been modified for use on radioactive samples, however to meet detection limits, large sample aliquots are still required. The extraction of PCB into a matrix consistent with quantitation methodology is labor intensive and therefore is performed outside the hotcell. Personnel performing this operation are exposed to significant doses of ionizing radiation. It is expected that the proposed methodology will require a much smaller aliquot of the radioactive sample to meet the required level of detection and therefore reduce the radiological exposure significantly. The proposed system is expected to eliminate the need for large volumes of methylene chloride or other carcinogenic or hazardous compounds currently required by the EPA procedure.
21	***Regulatory Drivers*:** PCB containing materials are controlled by the Toxic Substances Control Act (TSCA) and the measurement methods are included in the EPA methods compendium after acceptance. Concentrations of PCB in vitrification plant feed will also be controlled to control the air emissions from that plant during the heating process. Some congeners, if not removed during feed pretreatment, can be expected to volatilize, without destruction, during the melt heating process. The concentration of PCB will be required to minimize pretreatment operations and assure that emissions will be within operational permit limits. There can be cost and schedule impacts if PCB concentrations are not available in time for feed delivery, which in turn can perturb completion of TPA milestones on schedule. The cost, provided above, includes testing and negotiation to have the measurement system qualified and accepted for use as a standard method of analysis by the EPA.
22 *	***Milestones*:** Success in meeting the requirements of interface control document 19, 20, 23, and the Regulatory DQO depend on the application of this proposed measurement system. All milestones and performance initiatives associated with meeting these requirements will be positively impacted.
23 *	***Material Streams*:** Sludge, salt, liquid (RL-HLW-20)
24	***TSD System:*** Double Shell Tank and Single Shell Tank systems
25	***Major Contaminants*:** Pu-238, 239, 240, 241; AM-241; U-238; C-14; Ni-59/63; Nb-94; Tc-99; I-129;Cm-242; Sr-90; Cs-137; Sn-126; Se-79; chromium; nitrate; nitrite; complexants (EDTA/HEDTA)
26	***Contaminated Media*:** Tank waste consisting of high molarity sodium hydroxide/sodium nitrate solution containing saturated saltcake and/or sludge.
27	***Volume/Size of Contaminated Media*:** Approximately 50 Mgal. The single shell tanks are generally 75 ft. in diameter, and up to 40 feet deep with their tops buried about 10 feet below the ground surface. All double shell tanks are 75 feet in diameter, and about 40 feet deep, and are similarly buried.
28 *	***Earliest Date Required*:** October 2001
29 *	***Latest Date Required*:** 2005
Baseline Technology Information	
30	***Baseline Technology(ies)/Process*:** The baseline technology uses the standard laboratory methodology approved by EPA and Washington Department of Ecology at a cost of approximately $5000 for each analysis. This analysis is labor intensive and requires about a week to complete, generates a mixed waste, secondary waste stream that must be stored since no disposal options are currently available. **Technology Insertion Point**: The requested technology would supplement or replace the baseline methodology in the Hanford Site laboratory(s) performing PCB analyses.
31	***Life-Cycle Cost Using Baseline*:** Assume 50 tanks will be sampled at multiple locations for acceptability for Waste Treatment Plant feed. As shown above, the cost of analysis per tank is $100,000. Therefore the

	life-cycle cost for labor only is $5,000,000. No credit is taken for the reduction of radiation exposure which at $7,000 /person-rem could add an additional $70,000 in cost savings (500 samples x 20 mrem accumulated dose per sample = 10 rem x $7,000/rem = $70,000)
32	***Uncertainty on Baseline Life-Cycle Cost*:** The number of analyses for PCB concentrations required on the Hanford Site is more likely to exceed the estimation rather than be reduced. The number of analyses scheduled by the Waste Treatment Plant is not included in the estimates. Incidental requests on various wastes and support to blending activities of tank materials before final feed characterization have not been included in the previous estimates.
33	***Completion Date Using Baseline:*** Approximately 2035
Points of Contact (POC)	
34	***Contractor End User POCs*:** W.I. (Bill) Winters, NHC, 509-373-1951, F/509-373-2843, William_I_Bill_Winters@rl.gov
35	***DOE End User POCs*:** E.J. (Joe) Cruz, ORP, 509-372-2606, F/509-373-1313, E_J_Cruz@rl.gov J.A. (James) Poppiti, DOE-HQ-EM-44, 301-903-1733, F/301-903-7604, james.poppiti@em.doe.gov
36**	***Other Contacts:*** K.A. (Ken) Gasper, CHG, 509-3731-1948, F/509-376-1788, Kenneth_A_Ken_Gasper@rl.gov

*Element of a Site Need Statement appearing in IPABS-IS
**Element of a Site Need Statement required by CHG